PATENT SPECIFICATION 1,199,445

DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Method of Producing Castings of Plasticisable Material.

We, MASCHINENFABRIK UND GIESSEREI NETSTAL A.G., a Swiss Body Corporate, of Netstal, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a method for producing castings of a plasticisable material, particularly one plasticised outside a mould by the addition of heat, and then conveyed to the mould in this state. The material in question is advantageously a thermoplastics material but other low melting point material may be used e.g. low melting point metals.

By "plasticised" as used herein is meant a state in which the material to be treated is sufficiently softened to be moulded.

It is known to inject plasticised thermoplastics material under pressure into the mould, for example by means of one or more injection members, e.g. axially-movable screw conveyors or pistons from a plasticising or storage chamber. As soon as the injection member has completed its axial thrust, the next material charge (for the next blank) is plasticised and stored in front of the returning injection member, whereupon the next injection operation can take place. Of course, castings of different volumes may be produced with one and the same apparatus, the maximum casting volume possible being given by the size of the storage chamber or the maximum working stroke possible of the injection member of the apparatus. The invention aims on the other hand at an increase in shot volume attainable and to this end consists in a method of producing castings of plasticisable material, which is plasticised outside the mould by the addition of heat and which is then conveyed to the mould in this state, wherein the mould is filled with plasticised material in a first phase by intrusion without any substantial pressure rise, and in a second phase following the first phase without interruption of the flow of material to the mould, by injection at high pressure, the forces necessary for intrusion and injection being produced in one and the same chamber.

By "intrusion" as used herein is meant a process in which plasticised material is subjected e.g. to the action of a worm to facilitate softening, and advance of the material with little or no increase in pressure.

The injection phase established quantitatively by volume is preceded by an intrusion phase depending upon a practically pressure-free inlet of material into the mould, which phase is quantitatively determined for the main part by its time duration.

The total shot volume can thereby be increased many times compared with the previously attainable shot volume obtained solely by injection pressure.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawings which schematically show one embodiment of apparatus for carrying out the method of the invention and in which:—

Figure 1 shows, in axial section, the apparatus at the beginning of the plasticising phase,

Figure 2 shows a section similar to Figure 1 at the end of the plasticising phase,

Figure 3 shows a section similar to Figure 1 during the intrusion phase, and

Figure 4 shows a section similar to Figure 1 during the injection phase.

Referring now to the drawings the apparatus shown comprises a plasticising cylinder 2 surrounded in the usual manner by

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heating sleeves 1*a*, in which cylinder there is arranged a screw conveyor 3 which is axially movable and rotatable by any convenient drive means (not shown). A hopper 4 opens out into a cavity 2*a* of the plasticising cylinder 2 containing the screw 3. The conically reduced front end of this cylinder cavity 2*a* is connected, via a feed conduit 5, to a nozzle 6, which is connected, via an inlet channel 7*a* of a mould 7 to the mould cavity (not shown). A forward extension 2*b* of the plasticising cylinder 2 containing the feed conduit 5 is also surrounded by heating sleeves at 1*b*. The nozzle 6 can be opened or closed by a valve pin 8 which can be axially moved in either direction by a crank 9. The crank 9, pivotable about an axis *a*, may be actuated via a suitable time switch by means which have not been shown, such as mechanical, pneumatic, hydraulic or electrical means.

The first working step of the method of production consists in the delivery of plasticisable, e.g. granular material, through the hopper 4 into the cavity 2*a* of the cylinder 2. The nozzle 6 is closed and the screw 3 is located in its front end position, which it took immediately after the end of the preceding mould filling step. The material passing into the plasticising cylinder is plasticised under the action of heat; when the screw rotates this plasticised material flows into and fills the cavity 2*a* in front of the screw 3 and correspondingly pushes this into its rear end position (Fig. 2). This rear end position of the screw 3 is limited by adjustable stops (not shown); in this way the desired amount of screw thrust can be pre-set and the volume of material driven out of the cavity 2*a* by the screw during its forward thrust in the injection phase is consequently pre-determined. Subsequently, by a corresponding movement of the crank 9, the nozzle 6 is opened; the rotating screw 3 remains in its rear end position. The plasticised material (continuously supplied from the hopper 4) now reaches the mould 7 via the nozzle 6 by intrusion from the cavity 2*a*, through the conduit 5 (Figure 3). After the intrusion period, which can be set by a time switch, has ended, the rotating screw 3 is moved axially forwards; since the nozzle 6 remains open in this phase, plasticised material stored in the cavity 2*a* in front of the screw 3 is thereby injected through the conduit 5 into the mould which latter is thereby completely filled. Subsequently to this filling of the mould, (and after the usual pressure period has expired), the nozzle 6 is closed and the next working step (plasticising, shot measuring, intrusion and injection) can begin. It will be apparent from what has been said previously that the shot volume of each working step is considerably increased by the intrusion phase carried out during the plasticising phase and preceding the injection phase; in practice, it is quite possible to raise the total shot volume to 5 times the volume which was obtainable exclusively by injection. Since the injection follows the intrusion phase by axial thrust of the screw, directly and without any interruption of the flow of material, there is no fear of the injection moulding freezing, or undesired markings forming on its surface, during the course of the change from one phase to the other.

It will be understood that the shot volume can be increased by an intrusion phase preceding the injection phase, not only in injection devices incorporating a screw, but also where the injection member is a piston; it is only essential that there be no interruption in the flow of material between intrusion and injection phase, which on the one hand keeps the nozzle open and on the other hand effects the feed of the material to the nozzle or to the mould in both phases from the same plasticising chamber and through the same feed conduit. In order to accelerate the intrusion process, which takes place without any substantial pressure rise, means can be provided for transiently increasing the cross section of the nozzle and/or the speed of rotation of the screw during the intrusion process.

The described method is particularly suitable for producing castings made of a thermoplastics material. However, it is also possible to use low melting point metals.

WHAT WE CLAIM IS:—

1. A method of producing castings of plasticisable material, which is plasticised outside the mould by the addition of heat and which is then conveyed to the mould in this state, wherein the mould is filled with plasticised material in a first phase by intrusion without any substantial pressure rise, and in a second phase following the first phase without interruption of the flow of material to the mould, by injection at high pressure, the forces necessary for intrusion and injection being produced in one and the same chamber.

2. A method according to claim 1, wherein the amount of filling during the first phase is determined by controlling the duration of intrusion, whilst the remainder of the filling is effected with a pre-determined volume of material.

3. A method of producing castings of a plasticisable material, substantially as hereinbefore described with reference to the accompanying drawings.

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1 SHEET This drawing is a reproduction of the Original on a reduced scale

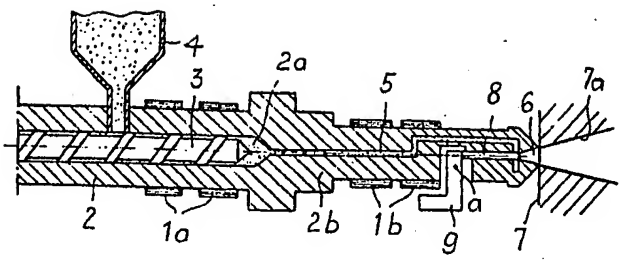

Fig. 1

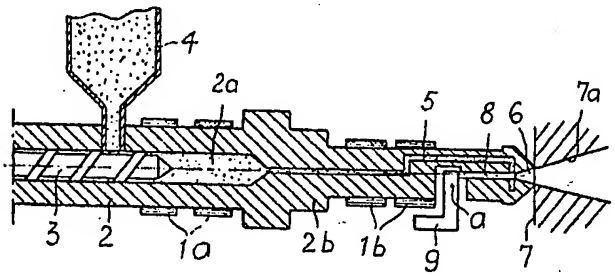

Fig. 2

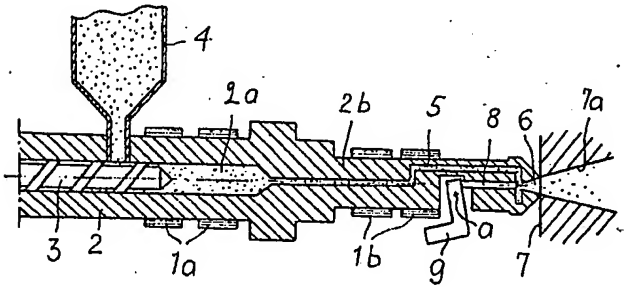

Fig. 3

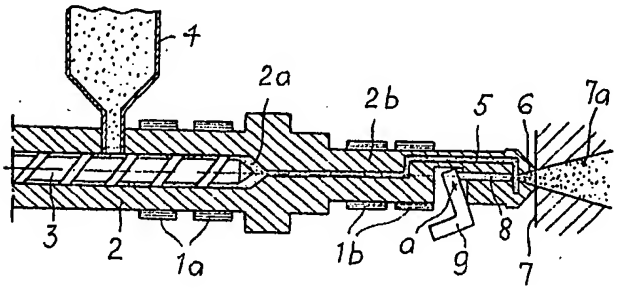

Fig. 4